

## COMMENTS ON THE MESOPELAGIC FAUNA OF THE NORTH AEGEAN SEA

by

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**ABSTRACT.** - One fishing cruise was performed in the N.Aegean Sea in July 1993, with the aim to study the mesopelagic fauna. Samples were taken from nine stations depth 250, 500, 750 and 1000 m using the METHOT midwater trawl. A total of 41 taxa were identified, from which only fishes were identified to species. The highest abundance of invertebrates was observed at 500 m, with the lowest value at 1000 m. Intermediate values were observed at 250 and 750 m. Euphausiaceae, followed by Chaetognatha, were the dominant taxa. Fifteen species of mesopelagic fishes were caught. About 90% of the sampled specimens were Myctophidae, which demonstrates the importance of this family to the ecology of the mesopelagic zone in the Aegean Sea.

**RÉSUMÉ.** - Commentaires sur la faune mésopélagique de la mer Égée nord.

Une campagne de pêche a été réalisée en mer Égée en juillet 1993 dans le but d'étudier la faune mésopélagique. Des échantillons ont été pris dans neuf stations de profondeur 250, 500, 750 et 1000 m en utilisant le chalut mésopélagique METHOT. Quarante et un taxa ont été dénombrés et seuls les poissons ont été identifiés au niveau spécifique. La plus forte abondance d'invertébrés a été observée à 250 et 750 m. Les Euphausiaceae, suivis par les Chaetognatha, sont les taxa dominants. Quinze espèces de poissons mésopélagiques ont été capturées dont environ 90% étaient des Myctophidae, ce qui démontre l'importance de cette famille pour l'écologie de la zone mésopélagique en mer Égée.

**Key-words.** - Myctophidae, Mesopelagic-fauna, MED, North Aegean Sea, Inventory.

Information existing on the mesopelagic fauna of the Greek seas is mainly based on data coming from the research cruises conducted by the vessels "Dana" and "Thor" at the end of the last century and the beginning of this century (Tåning, 1918, 1923; Ege, 1930, 1934). During the last decade, however, more active studies focusing on the mesobathypelagic fauna of the Greek seas have begun. In fact Papaconstantinou (1990) has described the distribution of some rare mesopelagic and bathyal fish caught in the Greek seas during the last years.

The scope of the present paper is to study the mesopelagic fauna of the North Aegean Sea, along the North Aegean Sea trench, reaching a maximum depth of 1100 m.

### MATERIALS AND METHODS

One fishing cruise was performed in the North Aegean Sea in summer 1993 (17-28 July) in order to study the mesopelagic fauna of the area. A grid of 9 stations was designed over the whole study area (Fig. 1). At each station routine samples were taken from

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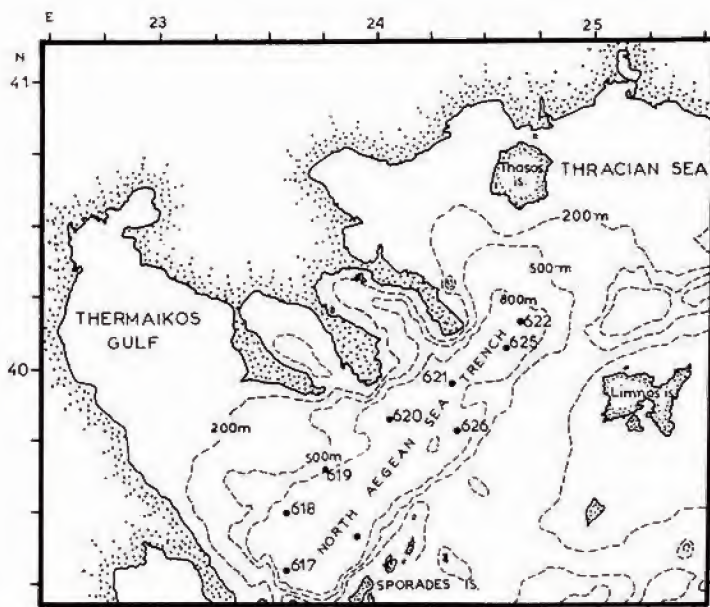


Fig. 1. - Map of the study area showing the sampling stations.

depths of 250, 500, 750 and 1000 m during daytime. The duration of each haul was one hour. For the sampling, the frame midwater trawl was used (Methot, 1986). The frame trawl is a micronekton net designed to sample pelagic larvae and juvenile fish that avoid plankton nets and pass through the mesh of large midwater trawls. The mouth of the frame trawl is a rigid, square frame with an area of 5 m<sup>2</sup>. Towing speed varied between 1.5-2.3 knots. The tow-speed, temperature and depth of towing were controlled by a SCANMAR system. The similarity index of Sorensen (1948) was used for comparing the ichthyofauna in the various depth zones.

Fishes were killed in 10% formalin immediately after capture and eventually stored in 75° ethyl alcohol. All fishes were measured at the nearest mm TL. The material used for this study is preserved in the Museum of NCMR.

## RESULTS

A total of 41 taxa were identified in the area, from which only fish specimens were identified to the species level. The highest abundance (number of specimens) of invertebrates (26 taxa) was observed at the depth of 500 m, while the lowest was at the 1000 m depth (Table I). Intermediate values were observed at depths of 250 and 750 m. The difference of the abundance between the four depth zones was considered statistically significant (Analysis of Variance,  $P < 0.05$ ). Euphausiaceae, followed by Chaetognatha, were the dominant taxa in the area (Table I). The abundance of these two taxa differ significantly in the various depth zones (Analysis of Variance,  $P < 0.05$ ). About 90% of the total number of the collected specimens were sampled at 750 m and above. The low abundance of Euphausiaceae at 250 m seems to be related to their diel migration to deeper waters. Gastropoda and Sergestidae Natantia were also well represented in the samples,



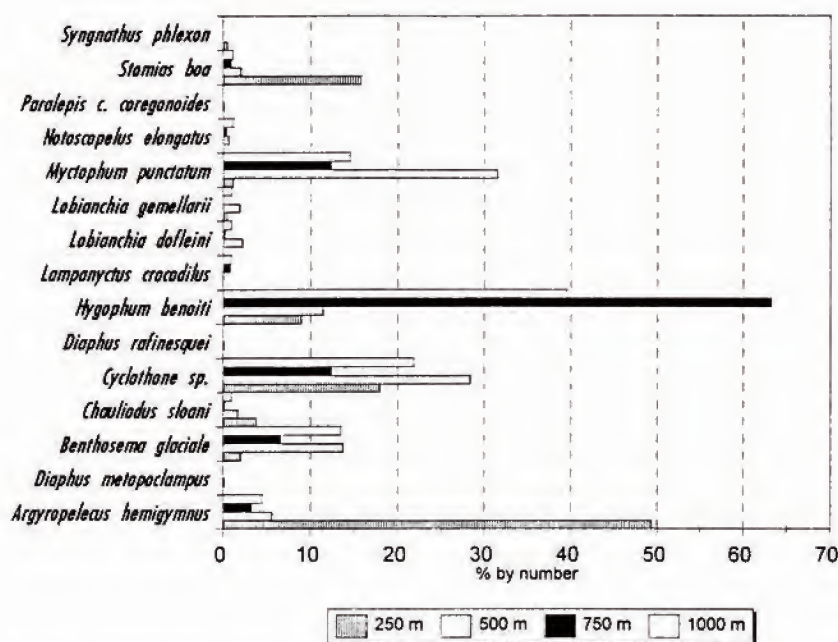


Fig. 2. - Bathymetrical distribution and abundance (%) of fishes collected at all sampling stations during the study.

and ranked third in the abundance scale, while their bathymetrical distribution differed from that of the first two taxa. About 70% of the Gastropoda were caught at the 250 m depth zone, while about 82% of the Sergestidae were caught at depths  $\geq 750$  m.

Four thousands one hundred thirty six specimens belonging to fifteen species of mesopelagic fishes were caught in the area (Fig. 2): *Argyroleucus hemigymnus*, *Diaphus metopoclampus*, *Benthoosema glaciale*, *Diaphus rafinesquei*, *Hygophum benoiti*, *Lampanyctus crocodilus*, *Lobianchia dofleini*, *Lobianchia gemellarii*, *Myctophum punctatum*, *Notoscopelus elongatus*, *Chauliodus sloani*, *Paralepis coregonoides coregonoides*, *Cyclothone sp.*, *Stomias boa* and *Syngnathus phlexon*. Of these species, nine belong to the Myctophidae, comprising almost 90% of all collected specimens and demonstrating the importance of this family to the ecology of the mesopelagic zone in the Aegean Sea. The geographical distribution of the five most rare myctophids that were collected in the area is presented below, and their meristic characters appear in table II.

*Diaphus rafinesquei*. - Two mature specimens were collected at a depth of 500 m (Table II). This is the first record of the species in the Aegean Sea. Tåning (1918) and Nafpaktitis *et al.* (1977) reported the presence of the species in the Libyan Sea. Moreover, the latter authors have found it in the Miroton Sea, Ionian Sea and Korinthiakos Gulf.

*Diaphus metopoclampus*. - Three specimens were collected at a depth of 500 m (Table II). This is the first report of the species in the Eastern Mediterranean. In the meantime between the collection of these samples and the presentation of this work, the species was also mentioned by Sinis and Koukouras (1995) in the northern part of Crete Island.

*Lobianchia dofleini*. - Forty two specimens were collected at a depth between 1000 and 500 m in the study area, presenting highest abundance at 500 m (Table II). This is the first report of the species in the North Aegean Sea. Previously the species has been fished only by Tåning (1918) in the Dodecanese area, while in the Ionian Sea it was reported by various authors (Nafpaktitis *et al.*, 1977).

*Notoscopelus elongatus*. - Twenty two specimens were fished in the study area at a depth between 500 and 1000 m, with the bulk of the specimens being around 500 m (Table II). The species seems to be endemic to the Mediterranean Sea, and is more abundant in the Western Mediterranean basin and in the Ligurian and Thyrrenian Seas. Only one record exists in the Eastern Mediterranean (south of Crete) and it was reported by Nafpaktitis *et al.* (1977), whilst Caragitsou *et al.* (1993) and Papaconstantinou *et al.* (1994) have identified the larvae of the species in the North Aegean Sea.

Table I. - Bathymetrical distribution and abundance of invertebrate taxa collected during the study.

Taxa	250 m	500 m	750 m	1000 m
Amphipoda	229	106	265	80
Chaetognatha	2639	3825	2513	733
Cnidaria	311	283	63	207
Copepoda	381	1036	628	219
Ctenophora	4	1	8	44
Enoplotheuthidae	0	1	0	0
Euphausiaceae	2226	9105	4211	1574
Gastropoda	1785	325	283	111
Histioteuthidae	3	3	1	0
Isopoda	0	6	1	0
Larvae of Brachiura	7	2	8	3
Larvae of Crustacea	20	19	37	8
Larvae of Decapoda	12	0	4	13
Octopoda	1	1	0	0
Ommastrephidae	0	0	1	0
Oplophoridae	5	5	100	47
Pasiphaeidae	10	9	24	23
Penaeidae	1	1	0	0
Polychaeta	210	94	142	67
Scyllaridae	34	36	34	11
Sepiolidae	17	9	4	0
Sergestidae	127	337	1524	725
Solenoceridae	31	10	12	5
Stomatopoda	11	18	23	1
Teuthoidea	0	0	0	1
Thaliaceae	38	20	6	1
<b>Total</b>	<b>8101</b>	<b>15232</b>	<b>9892</b>	<b>3873</b>
<b>n taxa</b>	<b>23</b>	<b>23</b>	<b>23</b>	<b>20</b>



*Lobianchia gemellarii*. - Thirty three specimens were fished in the study area, the majority of which were found at 500 m (Table II). According to Whitehead *et al.* (1986) the species is of Atlantic origin, while only three specimens have been reported till now in the Mediterranean Sea, two of which are coming from the Eastern Mediterranean (Nafpaktitis *et al.*, 1977). Early life stages of the species in the North Aegean Sea were discussed by Papaconstantinou *et al.* (1994).

The differences in the bathymetrical distribution of the various species of the family Myctophidae are well pronounced. They usually appear between 300 m and 800 m; 78% of *H. benoiti* occurred at 750 m depth and 60% of *M. punctatum* was found at 500 m depth. The relatively limited data on the abundance of the other species did not allow the extraction of similar conclusions. The presence of *S. phlegon* was considered occasional and was caught in upper waters, during the lifting up of the METHOT trawl. Approximately half of the sampled fish (49.2%) were caught at the depth of 750 m, while 35% and 10% at depths of 500 m and 1000 m respectively.

Table II. - Meristic characters of the five rare myctophids fished in the study area.

Species	D	P	V	A	SL (mm)
<i>Diaphus rafinesquei</i>	14	9	8	14	81 - 87
<i>Diaphus metopoclampus</i>	15	10	8	15	67 - 72
<i>Lobianchia dofleini</i>	16	12	8	14	39 - 47
<i>Notoscopelus elongatus</i>	21	12	8	19	92 - 98
<i>Lobianchia gemellarii</i>	17	12	8	14	57 - 71

## DISCUSSION

In the Mediterranean Sea, the vertical distribution of invertebrates and vertebrates showed many variations in relation to species. It may safely be stated that about 140-150 Mediterranean fishes, or a little more than 1/5 of the total number of species known to exist in the Mediterranean Sea, normally live below 200 m and deserve to be called "deep-sea fishes" in a broad sense, distributed among several orders and families. As is well known, the peculiar conditions of the deep zones of the Mediterranean do not favour the development of a true abyssal fauna. However, the following four demersal species are known to exist below 2000 m: *Centroscymnus coelolepis*, *Lepidion lepidion*, *Bathypetrolis mediterraneus* and *Chalinura mediterranea* (Tortonese, 1987). The last one, a macrourid captured at 2904 m in the Tyrrhenian Sea, provides the deepest record for the Mediterranean (Tortonese, 1960). Several fishes living in deep waters (*Chlorophthalmus*, *Stomias*, *Notocanthus*, etc.) were considered to be rare, but now are usually encountered in great numbers in trawl catches.

Almost all publications on the distribution of bathypelagic fishes in Greek seas that appeared in the previous years are based on the results of "Dana" and "Thor" cruises (Nafpaktitis *et al.*, 1977; Whitehead *et al.*, 1986). Information on the distribution of mesopelagic fishes in Greek seas during the last two decades that have appeared in various publications have been based on the results of research cruises, aiming mainly to the study of the state of demersal fish populations (Papaconstantinou, 1988; 1990). This information is extremely limited because of inappropriate sampling gear employed and entirely different orientation of the research, taking into account that: (a) the depth of

sampling rarely exceeds 500 m, (b) the mesh size used is 28 mm, resulting in a significant loss of relatively smaller individuals and/or species, and (c) mesopelagic fish are caught occasionally, while the net is on its way up, and as a consequence, it is not possible to know the depth, where they present their highest abundance.

The present work is the only one aimed exclusively on gathering information on the distribution of the mesopelagic marine animal taxa of the Greek seas. Fourteen mesopelagic fish species were sampled during the present work, six of which are recorded for the first time in the North Aegean Sea. The fact that the sampling area is influenced by Black Sea waters which are relatively colder, less saline and richer in nutrients than the waters of Levantine origin (Georgopoulos *et al.*, 1989; Theocharis and Georgopoulos, 1993; Stergiou and Georgopoulos, 1993), affects the fauna. The present data provide a more complete zoogeographic picture of the fish families in the North Aegean Sea.

A similarity index (Sorensen, 1948) using presence-absence data, was calculated to compare the abundance (number of specimens or species) of the mesopelagic fish at the different depth zones (Table III). Large differences in similarity would suggest biases for or against the various components of the assemblage censured (i.e., specimens, species). Values ranged from 69 to 95% illustrating a more constant level of faunal similarity for the assemblage censured regardless of depth zone. These values of the Sorensen's index increased with depth. According to various authors (Menzies, 1973; Fredj, 1974; Tortonese 1985), the number of endemic species living at deeper levels of the Mediterranean Sea decreases rapidly with increasing depth. This view is reinforced by the greater similarity of fish faunas as depth increases, which was calculated during the present study in the North Aegean Sea.

Summing up, this study resulted in a significant increase in the number of mesopelagic fish species recorded from the Aegean Sea. In table IV the number of species of the most abundant mesopelagic families in the North Eastern Atlantic and the Western

Table III. - Sorensen similarity index of the collected mesopelagic fishes at different depths, in the North Aegean trench.

	250 m	500 m	750 m	1000 m
250 m		0.69	0.74	0.8
500 m			0.83	0.88
750 m				0.95
1000 m				

Table IV. - Number of species of the most abundant mesopelagic families in the North Eastern Atlantic, Western Mediterranean and Greek Seas (Eastern Mediterranean).

	North-Eastern Atlantic	Western Mediterranean	Eastern Mediterranean	Greek seas
Photichthyidae	6	3	3	3
Gonostomatidae	17	3	3	3
Myctophidae	59	17	17	17
Chauliodontidae	2	1	1	1
Stomiidae	3	1	1	1



and Eastern Mediterranean (Greek Seas) appears (Whitehead *et al.*, 1986; Papaconstantinou, 1988). No great differences were established in the number of mesopelagic species between the two areas; the only exceptions were *Diogenichthys atlanticus* and *Goniichthys coccoi* that were found in the Western and in the Eastern part of the Mediterranean respectively. The above confirms Golani's view (1994) that no significant differences exist in the distribution of the mesopelagic fish species between the eastern and western Mediterranean, which contrasts with the results reported in previous studies (Tortonese, 1969; Ben-Tuvia, 1983; Fredj and Maurin, 1987).

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